AMRAD NEWSLETTER

Amateur Radio Research and Development Corporation July 1981

OUR JULY 6 MEETING will feature a talk and demonstration on direction finding by Chuck Phillips, K5LMA. The meeting will start at 7:30 P.M. and run until 9 P.M. when the library must close. The meeting will be at the usual place, the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, VA.

WE WISH TO THANK John Kanode, N4MM for speaking at our June meeting. Also, thanks go to the AMRAD Award winners who gave presentations on their science fair projects.

SPREAD SPECTRUM EXPERIMENT #1 -- on-the-air tests involving K2SZE, WA3ZXW and W4RI using a commercial frequency hopping rig -- has been completed. See Hal Feinstein's Spread Spectrum column in this issue. Members of the Spread Spectrum Special Interest Group are asked to keep the correspondence flowing to Hal.

PACKET RADIO ACTIVITY is moving at a fast pace as can be seen from Dave Borden's Protocol column. W4MIB, K8MMO and WB4JFI are actually on the air with a handful of others not far behind. If you are thinking of getting up on packets in the Washington, DC area, give Dave a call to find out how to get started. There's a little lead time involved because of the heavy demand for the VADCG protocol controller boards. Also, you'll need a Bell 202-compatible modem and power supply(ies).

Dave is in frequent contact with Hank Magnuski, KA6M in Menlo Park, CA. Hank reports considerable activity and progress involving stations operating through his (KA6M/R) packet repeater.

We are holding weekly skeds with Doug Lockhart, VE7APU on 20 meters, Saturdays at noon Eastern Time. If you want to listen on 20 meters, VE7APU is on 14178 kHz while W4RI transmits on 14204 kHz usb. Those in the Washington, DC area may hear the contact via the AMRAD repeater on 147.81/.21 MHz. K8MMO, WB4JFI, W4MIB and WB5MMB normally join in.

THE ARRL AMATEUR RADIO COMPUTER NETWORKING CONFERENCE is set for October 16, 1981, and that may seem to be sometime in the future. But those planning to present papers should start panicking right now if you haven't put pen to paper (or written to disk). The official deadline for letters of intent to present papers is August 15. These should be sent to W4RI. However, it would be a good idea to respond sooner in order to get a place on the program. Also, papers presented at the conference will be distributed either at the conference or later. All papers should be *camera ready* originals or really sharp photocopies. In order to keep reproduction costs to a minimum, all papers should be single spaced. If you have a really long paper, it would be helpful if you can type on 11 x 14-inch paper, in a two-column format similar to that of this newsletter) -- we can then reduce them to 8 1/2 by 11. To the extent possible papers received by a week or two ahead of the conference will be reproduced and available at the conference. Your paper will probably have more influence on those in attendance if you can get your paper in beforehand. If you have any questions, please call Paul Rinaldo, W4RI, 703-356-8918 days or eves.

ARTICLES ARE NEEDED for the AMRAD Newsletter on ham radio interfaces for popular microcomputers, homebrew Bell 202-compatible modems and computer aids for the handicapped. Honorariums are paid for articles printed at a rate of $10/page, $20 maximum per issue. Authors are asked to provide their own camera-ready artwork.

IF YOU KNOW OF A TYPIST in or near McLean who would be interested in part-time typing, has a Selectric or equal, wouldn't mind typing things like this newsletter, and can respond to deadlines, possibly we could work something out. The work would amount to about 16 hours per month. Please call Paul Rinaldo, 703-356-8918 days/eves.

THE DEAF AND THE TTY

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TELETEXT vs. LINE 21

For a change of pace, I am switching to a different subject, that of television, rather than telecommunication matters. There are some people who insist that because TDI is interested in telecommunications, it should also involve itself with the issue of television captioning for the deaf. At any rate, it is an issue that has unified, into one force, the diverse elements of the American hearing-impaired population. The object of the deaf people's ire is that CBS has refused to join with ABC, NBC and PBS in Line 21 closed-captioning venture for the deaf.

There are two different kinds of captioning: the *closed* (which uses Line 21 technology) with the assistance of a decoder, and *open* captioning. If you would tune into your local PBS station (it is on both channels 22 and 26 in the Washington, DC area) at a very late hour, you would see open captioning at work -- the delayed daily ABC 6 p.m. news.

A couple of years ago, the deaf community seemingly achieved a great breakthrough when the above-mentioned major television networks and Sears Roebuck stores agreed to provide the closed-captioning equipment. This euphoria was shattered a bit when CBS refused to endorse the Line 21 concept and proposed to go it alone with their highly controversial Teletext concept. Today, deaf households enjoy the benefits of closed captioning, but it could have been better had CBS chosen to join with the other networks.

It is the contention of CBS that the Line 21 technology was rendered obsolete way before it was introduced. They maintain that Teletext is by far much superior to Line 21. If this is true, then the $250 decoder equipment ever so necessary for the closed-captioning has become a white elephant. And if Teletext bears fruit, then the deaf people would be forced to buy additional equipment to accommodate CBS programs, thus cluttering the television set area.

Line 21 is simple. All that it provides is closed captioning, which is exactly what the deaf people wanted all the time along. Teletext not only provides closed-captioning potential (contrast it with promise for CBS has never given assurances that they will do closed captioning) but access to information-serving banks. The question is: do the deaf want closed captioning plus access to information banks?

Technology can be very confusing, and the potential of CBS' plans seem exciting. But does it duplicate what is already offered in such services as the Source, Micronet, and now the Washington Post electronic newspaper service and even the Radio Shack Videotex?

Is the CBS sword a double-edged one, not only rendering obsolete the Line 21 technology but also being hurt by the competition offered by various electronic information services?

All in all, CBS has never promised the deaf closed captioning. Line 21 has already been established and accepted by the deaf.

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UPGRADING HEX (Handicapped Education Exchange - an ASCII/Baudot computer bulletin board system operated by AMRAD) was the subject of a meeting on June 10 by Dick Barth, Terry Fox and Paul Rinaldo. Plans for this year include adding a front-end processor to handle more telephone lines and a hard disk to accommodate a larger data base. The existing HEX hardware consists of a Smoke Signal Broadcasting Co. 6800-based computer, two double-density double-sided 8-in disk drive, as well as Bell 103 and Weitbrecht modems.

Message-transfer techniques between CBBS' (in this case between HEX and the AMRAD CBBS) were also discussed. One problem in transferring messages between CBBS' is that different heading formats are in use. We are trying to come up with a labeling system which will permit transmission and rearrangement of heading elements. We plan to eventually propose a message-transfer protocol for use between message systems throughout the amateur packet network.

PROTOCOL

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NEWS

On June 5, 1981 after reburning the Line Interface Program (LIP) into PROM many times, a packet QSO finally was realized between K8MMO and WB4JFI (Terry). Although, as was reported last month, Bill Moran, W4MIB sent the first Metro area HDLC packet over the AMRAD repeater, Bill was on vacation when our packet QSO work began. Bill will join us soon in the happy world of error-free communication.

Approximately six Los Angeles area radio amateurs met on June 6, 1981 to discuss packet activity in L.A. and how to begin. Wally Linstruth, WA6JPR and Hans, K6MXF are apparently acting as spokemen for the group which hopes to join us in packet work. We of AMRAD wish this group luck and hope that they will link up with Hank Magnuski's group in San Francisco.

A packet radio beacon is now operational every 8 minutes on the AMRAD repeater. Soon this program will be expanded to a full-scale store-and-forward node that regenerates and repeats any correctly received packet. For the time being, a short message is transmitted in HDLC followed by CW identification.

Hank Magnuski, KA6M sent by mail the details of his San Francisco packet repeater. Using the Western Digital 1933 circuit on the STD bus, the board appears easy to construct. Terry, WB4JFI is studying the schematics with an eye toward S-100 application. Hall Feinstein, WB3KDU and Hank both suggest that AMRAD employ some high-level language, like PASCAL, in network software using assembly-language drivers as required. The KA6M repeater software is written in PASCAL, while the Terminal Node Controller (TNC) software is all assembly language. Doug Lockhart, VE7APU is employing STOIC (an offshoot of FORTH) in his station node software. Any ideas on this subject are welcome.

ADDRESSING

If the Metro area packet users are to communicate with the San Francisco area packet users over an HF link, some addressing scheme other than the current one is required. Using the current idea that a station node not be required for communication, fixed addressing is being employed. Addresses assigned so far are:

01 W4RI	02 K8MMO
03 WB4JFI	04 W4MIB
05 W1AW	06 W4CQI
07 WB5MMB	

Hank, KA6M employs an even more restrictive scheme than this. In order to get repeated through the San Francisco packet machine, your incoming address must be in the range of 80 hex to 9F hex. The repeater changes these to a range of A0 hex to BF hex. This means that Hank's machine can have 32 unique users currently. He now has 17 users. Where does AMRAD fit in? Hank wants us to have our packets appear on the output of his repeater. We could take one address (like 9F hex) for coast-to-coast linkup, but that is restrictive.

The international standard ISO 3309-1976 for High Level Data Link Control (HDLC) allows for extended addressing. By prior agreement, the address range can be extended by reserving the first transmitted bit (low order) of each address octet (8 bits) which would be then set to binary zero to indicate that the following octet is an extension of the basic address.

Schemes being suggested currently employ more overhead in the packet. Doug Lockhart, VE7APU is sending by mail details of his suggested extended addressing scheme. It involves a *network* address at the highest level, a *link* address at the second level and a *device* address at the lowest level. Other suggested schemes include ZIP/Postal Code, suggested by Jon Bloom, WB3JSV and Wally, WA6JPR as well as others. I include a letter from Jon on this subject as part of this column. Hal, WB3KDU is working on other high level addressing concepts.

TNC BOARD NOTES

The TNC software, supplied by KA6M, was revised by me to include a transmitter

turn-on delay for AMRAD users who have two-meter transceivers with relay transmit/receive switching. It delays for about 400 ms after turning on the push-to-talk line of the rig. Hank also included an excellent cw identification routine. Cw identification is not required under Canadian radio law, thus the original software written by Doug Lockhart made no provision for cw i-d. Hank has also programmed additional terminal bells and whistles such as cancel line, delete character, etc. K8MMO, WB4JFI and W4MIB now have copies of the latest release in read-only memory (ROM). I will be glad to burn ROM's for anyone having a completed board. You must supply desired terminal speed (baud rate) and call sign. Current packet call signs are six characters. Spaces pad out the call to the right (thus K8MMO becomes K8MMOspace). You should also supply $18 for three ROM's (Intel 2708). Future revisions of the software will only require the ROM's to be erased and reburned.

Hank, KA6M sent along 8273 chips on consignment. They are $35 per chip. Contact me at the address listed at the beginning of the column to get one.

SOME THOUGHTS ON PACKET ADDRESSING
by Jon Bloom, WA3JSV

In order to assure delivery of any packet to the destination terminal node, the packet must be addressed such that the destination terminal is uniquely identified. For packets which must be relayed between stations (that is, the destination terminal is not connected to the same station node as the originating terminal), the address must also indicate some form of routing information to tell the station node to which station node the packet must be relayed. The alternative to providing this routing is to force all stations in the network to attempt delivery of the packet, either by comparing the destination terminal address to a list of known users or by broadcasting the packet in hope that the addressee terminal will see it and connect itself to the station node to accept delivery of the packet. One can but imagine the effect of the latter technique in which, conceivably, hundreds of station nodes would be attempting delivery of the same packet at the same time! Given, then, that some form of routing information is necessary, the questions with which we must contend concern the type of routing information and the manner in which the station node will use this information.

Two possible routing systems spring to mind. The first of these would require that each station have knowledge of all other stations in the network. With this system, the originating terminal would have to provide the station address to which the destination terminal is connected. The originating terminal's station would then compare this address against an internal table to find the address of the next station on the route to the destination. This system would require that stations and terminals all have knowledge of all stations in the network. Not only would this inhibit the transparency of network operations to the user -- a highly desirable attribute -- but it would also place an untenable burden on the individual user as the network grows and changes.

The second possible system is one in which the routing information defines a geographic location or region. Using a system of this type, the relaying station need only know of the stations with which he is in direct contact. A short table matching geographic locators with stations would allow the relaying station to select the station to which the packet should go next. As the packet nears its destination, the geographic locator would be used to define the precise destination station. An example of an exising system of this type is the U.S. Postal Service ZIP Code system. In this system, each five-digit number specifies a unique geographic location (i.e., post office), equivalent to a station node of the packet network. Each group of numbers specifies a geographic area (such as a bulk mail center). Successively larger groups of numbers relate to successively larger geographic areas. Using such a system in the packet network, an east-coast station receiving a packet would scan the locator code and, finding that the first digit specified a west-coast station (for instance), would relay the packet to a station west of his location. As the packet neared the west coast, the relaying stations would scan further "down" (to the less significant digits of) the locator code to more precisely determine the direction to relay the packet. When a station in direct contact with the station handling terminals of that locator code receives the packet, it would, of course, relay it directly to the destination station for delivery to the destination terminal. Thus each station must be aware of the locator codes handled by the stations with which it is in direct contact.

It may well be that the ZIP Code is not the ideal system to use for packet addressing. I feel, however, that a system using the philosophy of increasingly specific number groupings has advantages over other systems which have been proposed. The advantage of the ZIP Code system is that it is already in place and is widely accepted and understood.

Note that this system requires a two-level address. The first level is the geographic station locator, the second level being the individual terminal address. I would suggest that the terminal address format be devised such as to allow not only radio station identifiers but also landline connections to the station node (i.e., phone numbers). This would allow access to users other than those with radio transmission/reception capability. Naturally, access control procedures such as passwords could be implemented as desired by each individual station node operator.

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SPREAD SPECTRUM

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Well, I can report some new things this time around for the spread spectrum effort.

EXPERIMENT #1

First, we had a series of very successful frequency hopping experiments carried out by Paul Rinaldo, W4RI, Dick Kessler, K2SZE (in Rochester, NY) and Olaf Rask, WA3ZXW (in Annapolis, MD). Experiment #1 of the AMRAD Special Temporary Authority (STA) called for tests with a commercial/military frequency hopper in the 80-, 40- and 20-meter bands. These rigs are capable of a frequency range of 2 to 15 MHz and hopping speeds adjustable from about 1 hop/s (1 chip for you units buffs) to about 20 hop/s. The hopping sequence was assumed to be nonlinear because this rig was meant for military purposes. Normal linear sequences of short duration are not useful for military applications.

Using these rigs is somewhat different from a standard single sideband (ssb) transceiver, but enough of the operations are the same that an amateur would feel right at home with this mode. I was able to sit in on a session that Paul Had one evening and will describe what I heard.

First, both stations made contact using ssb (this was on 75 meters) on a *service frequency*. The next major item was making sure that the hopping sequence generators on both rigs were set the same way. The rig has a set of thumb wheels on the front panel which are used to control the hopping sequence. Both stations set the wheels the same way. If the wheels had been set differently, the hopping sequences would be different, and the two stations couldn't talk to each other.

Now that the hopping sequences were set the same way, one station would transmit a special fsk signal which the other station would receive. This fsk signal serves to alert the other station to start hopping as soon as the fsk signal stops. The fsk signal was generated by using the SEND SYNC switch on the rig. To set up the second station to use this fsk synch signal, there was FAM (frequency-agile mode) switch position to enable the second station to lock on to the fsk signal.

When the fsk signal stopped, both rigs were in the hopping mode. The speed at which the hopping took place was 5 hop/s, which is slow as hopping goes but has many interesting features. The mode of transmission was ssb, and Dick's signal came in very well. I was surprised that the rig's synthesizer was right on each hop, which meant that the ssb signal was very clear. No "duck talk" was present, such as comes from being a little off with an ssb signal.

One of the main advantages of spread spectrum was the so-called *antijam* or interference avoidance feature which happens because the background QRM is being changed every hop. We were hopping at 5 hop/s with this rig, and I was able to observe this effect. Dick's voice was more readable than when in (non-hop) conventional ssb mode. We made a few experiments by moving the hopping sequence up a little to see what it would do against solid, congested ssb.

In the first part of the experiment, we were in the 80-75-meter band, which resulted in the hopping sequence varying mostly in the cw portion, but it would visit phone stations now and then. What did this sound like? Well, all the sounds that hams are used to were present, but every one fifth of a second the sound would change! What you would hear was a snatch of RTTY, a small burst of cw, a few sounds from some ssb station and some snap of QRN, each lasting only a fifth of a second.

It was easy to hear Dick's voice with this ever-changing background noise because Dick's signal was strong. There was some fading now and then, and this let us see what a weaker signal would sound like. When K2SZE's signal became weak, it was still readable even when it started to fade into the strange background sounds. My old cw training came back to me, and I mentally started to try and shut out the background, just as you do when receiving a weak cw station in heavy QRM. But this time the background sounds were changing!

I would say that there was about 30%

ssb sounds in the mix with most being cw and RTTY. There was an advantage over normal ssb with this mix. Then we moved the hopping sequence into the 75-meter phone band. Both stations had to reset the service frequency higher and then go through the sync process again, which is not hard. This time we had a mix of 80% ssb and 20% cw and RTTY. With this mix Dick's signal was hard to hear. Because there was such a high percentage of ssb in the background, it was difficult to pick out Dick's signal from the rest. We tried to lock onto Dick's voice and ignore the rest. But this was difficult. Things were much better with more cw and RTTY in the mix and downright hard with a high percentage of ssb.

What conclusion can be drawn from this? With slow hopping (5 hop/s), ssb frequency hopping does well against cw-like signals and poorly against voice-type signals. The fact that we were hopping at 5 hop/s didn't allow us to take advantage of a property that fast hopping has. If we were hopping faster (say 25 times a second) very short snatches of the background noise would be received. As the frequency is changing so fast, the sound of each of these snatches would just meld together and form a kind of buzz. The ssb voice signal would still sound like an ssb voice signal, but the background would sound very constant. With the right filters to treat the background buzz, the voice signal should be readable. This would happen even with a strong mix of ssb signals in the background because the amount of signal from each frequency would be very small. This is what we would like to try a little later with Experiment #2 which allows us to build our own frequency hopper rig out of old CB sets.

As part of the experiment, Paul turned on his ICOM IC-701 so that we could hear what a conventional receiver would hear with the other rig transmitting in the frequency hopping mode. Paul picked out a place on 80 meters where it was quiet and let the receiver stay there. We didn't hear K2SZE's signal on this receiver, partially because it wasn't connected to an antenna. When we went to transmit mode, every once in a while you would hear a snatch of sound like "aup" or "thu," but it would be gone as quickly as it came. This was the result of the rig hopping in a random way.

EXPERIMENT #2

A few of the AMRAD Spread Spectrum Special Interest Group have been interested in doing something with old CB transceivers. Allan Kaplan, W1AEL in Richardson, TX has a bunch of good ideas. The last time I spoke with him, his group was in active search of a number of Hy-Gain surplus CB boards to use as the basis of a 10-meter frequency hopper.

I was able to get hold of two ssb CB transceivers which were modified for 200 channels and had seen extensive use in another "service," Both of these rigs have almost identical internals and use the standard uPD858C synthesizer chip. This chip has a number of components for a synthesizer built right onto the chip. External to the chip is an active bandpass filter, a main VCO chip (which produces the output frequency) and a number of mixers and oscillators used to mix the VCO output for use in the CB transmitter and receiver.

In order to frequency hop, there are three things that need to be done: (1) change the mixer crystals so that the rig operates in the 10-meter band (this is in progress now), (2) modify the feedback filter so that the synthesizer will lock up faster, and (3) hook the BCD frequency programming lines to a controller board.

The controller board will have a linear feedback shift register which has parallel output and will gate an IC which has 8 spst (single-pole single-through) switches implemented in solid state. This IC will do the actual switching of the synthesizer programming lines for isolation's sake.

A second stage of the board will be used to sense/send a tone which will be used the same way that the special fsk signal is used by the commercial rig mentioned above. When the signal appears, the clocking associated with the shift register will go into a make-ready-to-hop state. Then, when the signal ends, hopping will start and continue until the stop-hopping switch is pressed. Lastly, a timing source is needed, and this will be supplied by a high stability crystal oscillator which will be on board as well.

K2SZE points out that timing is critical with fast frequency hopping. For now, we don't plan to hop very fast. Only when we have gained more experience with slow hopping will we try the faster stuff.

One problem being researched is that of how to get the loop filters of the synthesizer to react faster. The loop filter sits between the output of the phase comparator/charge pump and the VCO. Its job is to filter the correction voltage to the VCO to eliminate high-frequency components. So, the output of the phase comparator/charge pump goes through a low-pass filter before being applied to the VCO.

This loop filter in the two CB rigs consists of an active filter which is part of the uPD 858C and a second filter which is a bandpass filter implemented as an active discrete transistor amplifier. The feedback network for the active filter within the uPD858C is via a resistor-capacitor combination attached to some of the 858's pins.

Both CB rigs are slated to be modified in the same way so that there will be two rigs which do the same thing right off. Differences in the synthesizer design or the

controller board will probably produce a different hopping sequence. So, if you plan to do this *always* get at least two rigs of the same kind.

On the reverse of this page you will find a proposed logic sequence for the frequency hopper control board and a block diagram showing the basic functions.

SPREAD SPECTRUM INVADES PACKET RADIO

Recently, the packet gang at AMRAD have learned that some experimental packet radio systems use spread spectrum. The primary one is DARPA's (Defense Advanced Research Projects Agency) PRNET. Now, what can spread spectrum offer?

Well, all packet radio nodes transmit and receive on the same frequency. Each node tries to get its packets out as quickly as possible and then listen for packets addressed to it. As you might expect, sometimes two or more nodes try to send packets at the same time. The result is a collision. If a collision happens, both nodes will try again later. Some experiments revealed that when these nodes wildly try to transmit their packets, very few packets get through. So a number of plans have been cooked up to rule the channel and give order to an unordered universe of nodes. These plans go by different names like Aloha (yes, this was named by the University of Hawaii), Slotted Aloha, CSMA (carrier sense multiple access which is now in use by AMRAD), LWT, etc. All these plans try to get as little collision as possible while maximizing the number of packets transmitted.

Now spread spectrum can help this collision problem. Spread spectrum allows a station to lock out interference from all sources except the one which has the proper code sequence. Suppose that we assign a different code sequence to each packet node. In this case, a node would scan the list of sequences assigned to the other nodes and if it heard a transmission, it would quickly find the sequence of the node transmitting to it. Then it would lock onto that sequence and exclude any other node trying to interfere. There would be no collisions except when two stations started to send almost at the very same time.

Beside providing this anti-collision property, spread spectrum also provides privacy (in addition to a bitwise transposition cipher in PRNET for the data). As you might suspect, this technique has a four-letter acronym SSMA (spread spectrum multiple access).

I should point out that AMRAD has no plans to add spread spectrum to our packet networking planning. The main reasons are that spread spectrum would complicate things as well as increase the cost of getting packet radio going.

AMRAD SSSIG NEWSLETTERS

Soon after the STA was received, we wrote some newsletters directed exclusively to those involved with spread spectrum experiments. These newsletters have been discontinued and are replaced by this column so that all AMRAD members can tune in on what's happening in amateur spread spectrum.

FOR THE RECORD

Since we started this project, we've learned a lot about the spread spectrum mode which was heretofore unknown in the amateur community. A source of information about spread spectrum is a book by Walter C. Scales of the Mitre Corporation entitled, "Potential Use of Spread Spectrum Techniques in Non-Government Applications." It was prepared under contract to the FCC Office of Science and Technology's Technical Planning Staff. Copies of the report are available from the National Technical Information Service, Springfield, VA 22161. The accession number is PB81-165 284, cost is $17 paper, $3.50 microfiche.

We have heard that the FCC Commissioners are about to consider a proposal that spread spectrum be made a legal mode for U.S. amateurs. This topic was originally scheduled for hearing by the Commissioners on June 4 but was rescheduled for June 16. We will be in attendance and will have some details for you in the next newsletter.

The FCC has certainly been forward looking with regard to spread spectrum as well as other advanced amateur technology. In particular, Mike Marcus and Carlos Roberts have been very supportive in these areas of experimentation.

THE NEXT STEP

At one point we had talked about the idea of kits being made available for the builder. It turns out that we have a lot more ground to cover with the experimental aspects of spread spectrum before we can get to a prototype. The whole idea of the STA is to experiment. So, if you're not sure how to proceed and want to talk it over with someone, I suggest that you find someone close to you and work together. The converted-CB approach seems the simplest way to start.

We need to give some thought to restarting the 20-meter phone net for spread spectrum discussions. I will be up on the AMRAD 2-meter repeater regularly now that I have a power amplifier and will be glad to talk about designs or what have you.

Next issue I will try to get some specifics down in print about the CB conversion for spread spectrum. I will also try to report on what's going on in the special interest group. □

FUNCTIONAL FREQUENCY HOPPER CONTROL BOARD

LOGIC SEQUENCE

Control Lines:

(1) SEND TONE.....Turn on sync tone oscillator
(2) SYNC TONE DETECT.....Presence of sync tone in receiver audio. Means that other unit has transmitted sync tone.
(3) RESET SHIFTREGISTER.....Clear out current contents of shift register and load value of thumbwheels
(4) INHIBIT HOPPING.....Gate off the clock which drives the shiftregister.
(5) MODE SELECTOR.....Signal the mode we want to be in. There are three aux. lines associated with this line which are not named.
(6) TRANSMIT ON.....Key the unit's transmitter.

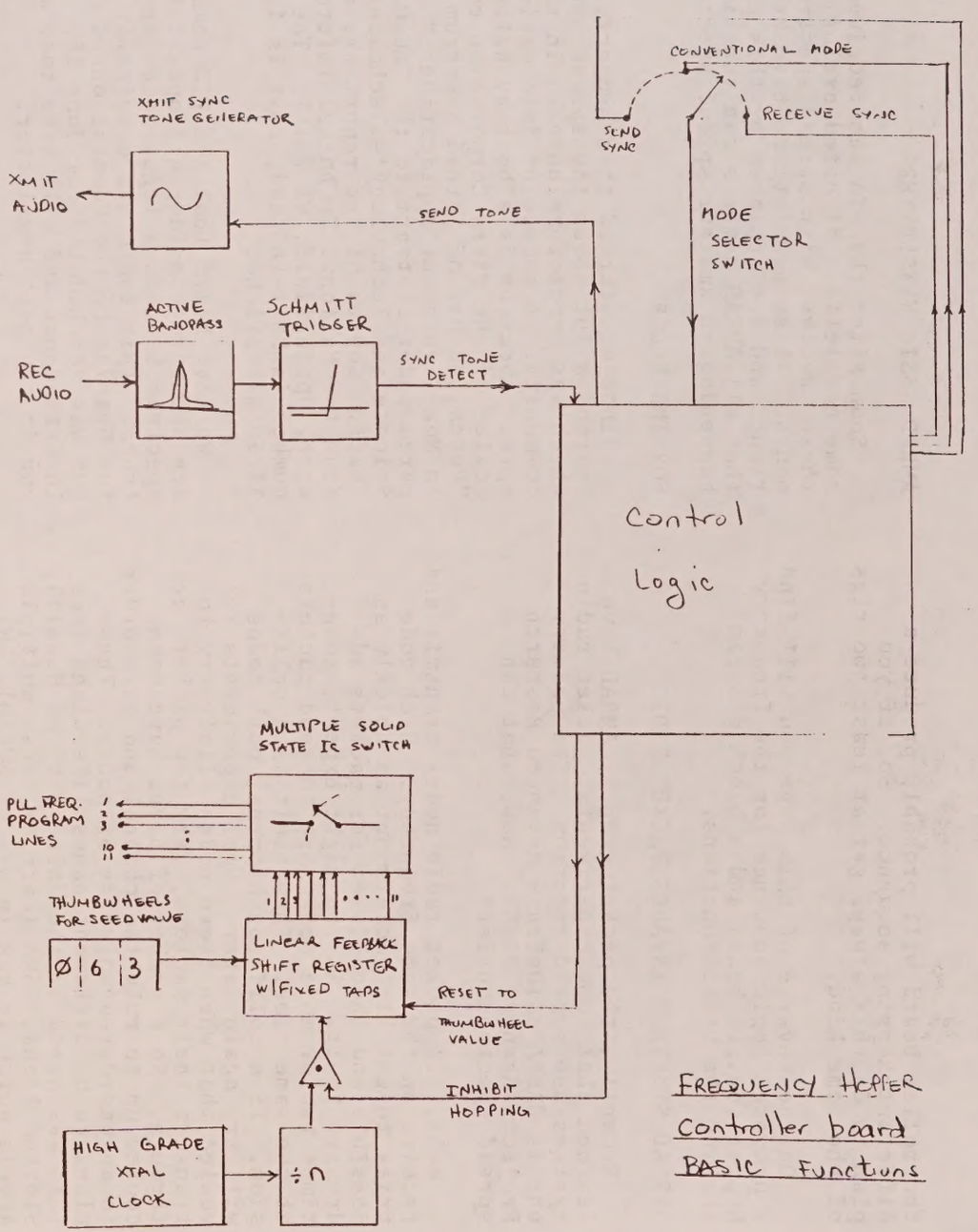
Sequence Logic (controlled by mode switch)

SEND SYNC
(1) If hopping enabled force to CONVENTIONAL MODE.
(2) Lock out SYNC TONE DETECT.
(3) Enable TRANSMIT ON. (turn on xmit)
(4) Enable SEND SYNC (xmit sync tone)
(5) Wait 3 seconds. (by an internal timer)
(6) Disable TRANSMIT ON, SEND SYNC
(7) Disable INHIBIT HOPPING. (start hopping)

RECEIVE SYNC
(1) If hopping enabled force to CONVENTIONAL MODE.
(2) Enable SYNC TONE DETECT.
(3) Wait for SYNC TONE DETECT to go high. (sync tone received)
(4) Wait for SYNC TONE DETECT to fall. (sync tone falls)
(5) Disable INHIBIT HOPPING. (start hopping)
(6) Lock out SYNC TONE DETECT.

CONVENTIONAL MODE
(1) Enable INHIBIT HOPPING. (stop hopping)
(2) Trigger RESET SHIFTREGISTER. (load thumbwheel values)
(3) Lock out SYNC TONE DETECT. (in case we are resetting)
(4) Disable SEND SYNC, TRANSMIT ON. (in case we are resetting)

note: Conventional mode is also a recovery position which is used by the other two modes and by the operator to recover from a foul up in such as no sync tone received for a very long time when one is expected.



FREQUENCY Hopper Controller board BASIC Functions

Computer Selective Calling

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The Hard-wired selective calling device has been used by RTTY enthusiasts for many years. The advent of computer-based RTTY systems has made a much more flexible selective calling system available. For some reason which is not obvious to me, some of the most popular RTTY systems for computers do not include this obvious feature in their software.

Typically, selective calling devices are used to turn on printers or reperforators. Of course, any device could be controlled by the selective calling output.

Selective calling boards have a fixed word length, normally four characters, and require duplication of hardware for discrete decoding of several command words. A computer requires only a minor program change to add functions, and the command words can have random lengths. What happens when the command word is recognized is also readily changed in software.

I have developed a selective calling subroutine for use on RTTY that is flexible in terms of both command word length and format. I use code sequences that are within standard amateur operating practice so that the user need not know anything about my computer system to leave me a message. No special leading characters are required.

The selective calling routine shown below is written for the RCA VIP computer; however, it could easily be adapted for any microprocessor.

In my computer RTTY system, input code is converted to ASCII and stored in a memory location I call VØ in the disassembled listing below. When each new character is received, VØ will contain the hexadecimal equivalent of the ASCII code (even if the original input was Baudot). If no character is received, VØ will have a value of zero.

The command recognition subroutine uses a list of command word indices beginning at memory location ØB4Ø to point to the command word list beginning at ØB5Ø hex. For example, the command word index at ØB4Ø is 5Ø hex which points to the first command word which in the example below is my call sign, W3FEY. The next byte at ØB41 is the count of how many sequential characters in the command word have been matched by the incoming code. Initially, the count will be zero.

Let's assume that someone sends my call sign. The selective calling subroutine adds the index at ØB4Ø to the count at ØB41 to point to the first letter of my call at ØB5Ø. When the "W" is recognized, the count at ØB41 will be incremented to Ø1. When the next character is received, the index at ØB4Ø will again be added to the count at ØB41 which will now point to ØB51, i.e., "FIGS." (Conversion from Baudot is assumed in the example.) After each successful match, the subroutine looks ahead to the next character to see if it is an ASCII ETB (end of transmission block). When the ETB character is found, this indicates the end of the command word. If at any point, the incoming code fails to match the next character of the command word, the count is reset to zero, and the sequence must start over. As each code character is received, it is compared to each word in the command list. Thus, there can be an indefinite number of commands of any reasonable length.

When a command is recognized, the low byte of the memory address for the end of the command is stored in V7. Other parts of the program test the value of V7 to determine which, if any, commands have been recognized.

In my system, I store traffic following W3FEY, QST, LTRS ART, and LTRS LTRS ART in memory for later recall. N N N N terminates memory storage until another turn-on command is received.

Note that any input code could be used to drive the selective calling. For example, DTMF (tone) codes could be substituted for the ASCII codes used here. For critical control functions as in a repeater system, it would be wise to add some protective features such as timing limits and false code detection.

A disassembled machine-language listing for the selective calling subroutine follows on the next page. CPU registers R6 and R7 are set to point to memory page ØBXX by other parts of the program. Only the low byte of these registers is set by the selective calling subroutine. Using this disassembled listing you can easily convert this subroutine for use on your own computer.

W3FEY Computer Selective Calling Program:

```
ADDRESS  CODE  COMMENTS

0850     F8    POINT R6 AT V0
0851     F0
0852     A6
0853     06    LOAD V0
0854     32    RETURN IF NO INPUT
0855     81
0856     AF    STORE IN RF
0857     F8    POINT R7 AT INDEX LIST
0858     40
0859     A7
085A     07    LOAD INDEX
085B     FB    TEST END OF LIST
085C     FF
085D     32
085E     81
085F     E7    SET R7 TO RX(DATA POINTER)
0860     47    LOAD INDEX AND ADVANCE
0861     F4    ADD COUNT TO INDEX
0862     A6    POINT R6 TO COMMAND WORD
0863     E6    R6 TO RX
0864     8F    GET INPUT CODE
0865     F3    TEST FOR MATCH
0866     3A    GO IF NO MATCH
0867     7C
0868     16    INCREMENT R6
0869     06
086A     FB    TEST END OF COMMAND
086B     17
086C     32    GO IF END
086D     75
086E     07
086F     FC    INCREMENT COUNT
0870     01
0871     57
0872     17    INCREMENT R7 TO NEXT INDEX
0873     30    GO NEXT COMMAND
0874     5A
0875     86    STORE INDEX IN RF
0876     BF
0877     F8    POINT R6 AT V7
0878     F7
0879     A6
087A     9F    PUT INDEX IN V7
087B     56
087C     94    CLEAR COUNT
087D     57
087E     17    INCREMENT TO NEXT INDEX
087F     30    GO TO NEXT WORD
0880     5A
0881     D4    RETURN

      DATA FOR SELECTIVE CALLING SUBROUTINE

0B40     50
0B41     00
0B42     58
0B43     00
0B44     60
0B45     00
0B46     68
0B47     00
0B48     70
0B49     00
0B4A     FF
0B50     57    W
0B51     0F    FIGS
0B52     33    3
0B53     0E    LTRS
0B54     46    F
0B55     45    E
0B56     59    Y
0B57     17    ETB
```

□

CORRESPONDENCE:

Dear Paul,

I have been following the discussions on your proposed RTTY only repeater with great interest. You may be interested in the Prodelin hardline deal:

Prodelin, Inc. has a ham special on production over-runs of 1/2-inch and 7/8-inch foam line. They have plenty of 7/8-inch line at this time for 60¢/foot. Connectors are $30 each factory installed which is advised. Deal is for hams only, no commercial sales. Cash up front, transportation: COD or pick up at the factory. There is a waiting list for 1/2-inch line. Contact Bill Dickson on 609-448-2800 to place orders.

I have a repeater site at Strasburg, PA where we have the 223.30/224.90 repeater and a 462 MHz commercial repeater. I have operated on both 220 and 432 MHz from this site and I know that reaching into Northern Virginia is no real problem on 220 and reasonably easy on 432. Of course this was with horizontal polarization and about 50 watts to a 32 el array on 220 and about 25 watts to a 64 el array on 432. How well it will work on vertical polarization I don't know but the state of the art has changed radically since I was doing that work.

I hope to get down in October for the ARRL sponsored meeting on computer networking if the program seems interesting, I assume the AMRAD Newsletter will have details as the time approaches.

I note that AMRAD has conversions to use several home computers on the deaf network. I haven't studied exactly what is required to do this but I suspect that my VIP RTTY system could be used as well on the deaf net as it is on the air monitoring the Harrisburg RTTY repeater all day. If RS-232 is required that is simple to add.

73,
George S. Gadbois, W3FEY

Ed. Note: Thanks, George, for the article and letter. Plan on coming in October as it <u>will</u> be interesting and details will be in the newsletter. I would guess that your VIP RTTY system will work as a deaf TTY - just use 1400 Hz mark and 1800 Hz space.

UNPROTECT is a program for CP/M* that will provide you with the original source listing for any program which you have saved under the protect option in Microsoft BASIC-80**. $70. UNDELETE permits a single command to fully restore a disk file just as it was before the KILL or ERASE command. $45. Write: Systemation, Inc., P.O. Box 75, Richton Park, IL 60471 or dial 312-481-2420. *CP/M is a trademark of Digital Research. **BASIC-80 is a trademark of Microsoft Corp.

FLOPPY DISK DRIVES CAN BE RECONDITIONED by TransDataCorp, 1717 Old Country Rd, Belmont, CA 94002, 415-591-5705. In 30 days they will recondition Shugart, Pertec, CDC, Memorex and MFE drives for prices ranging from $95 to $225 and warranty 6 months on all parts and labor.

DIP, INC has introduced a line of dot matrix printers. DIP-81 is the lowest priced, about $499. It has friction feed, two character sizes, bidirectional 7 x 7 printing at 100 cps, 80-character buffer, and upper and lower case with 96-character ASCII set. Write: 121 Beach St, Boston, MA 02111, phone 617-482-4214.

COMPUTER INFORMATION EXCHANGE, INC. sent us some samples of cassettes entitled, "Newtech Music Box Music Synthesizer Sampler Orchestra 80," and "Head Azimuth Alignment Tape," as well as news releases on a compiler demonstration tape and Super-PIMx data base management system. For more info write CIE, Box 159, San Luis Rey, CA 92068, phone 714-757-4849. If you have a Radio Shack TRS-80 computer and would like to evaluate the above samples for the rest of the TRS-80 users in the club, please contact Paul Rinaldo.

ROCHESTER INSTITUTE OF TECHNOLOGY (RIT) will offer two computer courses for deaf adults this summer through the National Technical Institute for the Deaf (NTID). Courses are: Introduction to Data Processing, Aug 3-7; and, Advanced Data Processing, Aug 10-14. Contact Donald Beil, RIT, One Lomb Memorial Drive, Rochester, NY 14623, telephone 716-475-6373 on voice or TTY. Both courses feature hands-on practice.

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THE AMATEUR RADIO RESEARCH AND DEVELOPMENT CORPORATION is a technically oriented club of about 400 radio and computer amateurs. It is incorporated in the Commonwealth of Virginia and is recognized by the Internal Revenue Service as a tax-exempt scientific and educational organization.

THE PURPOSES OF THE CLUB are to: develop skills and knowledge in radio and electronic technology; advocate design of experimental equipment and techniques; promote basic and applied research; organize forums and technical symposiums; collect and disseminate technical information; and, provide experimental repeaters.

MEETINGS ARE ON 1st MONDAY of each month at 7:30 p.m. at the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, VA. If the 1st Monday is a holiday, an alternate date will be announced in the *AMRAD Newsletter*. Except for the annual meeting in December, meetings are normally reserved for technical talks - not business.

THE WD4IWG/R REPEATER is an open repeater for data communications (including RTTY), voice and experimental modes. It is located at Tyson's Corner, McLean, VA and has excellent coverage. It features a semi-private autopatch available to licensed members. Frequencies are: 147.81 MHz input, 147.21 MHz output. The head of the technical committee is Jeff Brennan, WB4WLW, 7817 Bristow Dr, Annandale, VA 22003, phone 703-354-8541.

THE AMRAD NEWSLETTER is mailed monthly to all members and to other clubs on an exchange basis. Technical articles, new product announcements, news items, calls for papers and other copy related to amateur radio and computing are welcome. Honorariums at a rate of $10 per printed page ($20 maximum per author per issue) are paid for original material accepted. Classified ads are free to members. Commercial ad inquiries are invited. The editor reserves the right to reject or edit any portions of the copy. Items should be mailed by the 8th of the preceeding month to Paul L. Rinaldo, W4RI, Editor, 1524 Springvale Ave, McLean, VA 22101; phone 703-356-8918. Full permission for reprinting or quoting items appearing in the *AMRAD Newsletter* is granted provided that credit is given. Mailing is by 3rd Class bulk mail to U.S. addresses and 1st Class to Canada and Mexico. Overseas readers add 96¢ for surface or $7.80 for air mail to annual dues.

THE AMRAD MESSAGE SYSTEM is an S-100 Computerized Bulletin Board System on 703-734-1387, system operator Terry Fox, WB4JFI. Terry's home phone number is 703-356-8334. The system accepts 110, 300, 450 and 600 baud ASCII callers using Bell 103-compatible modems.

THE HANDICAPPED EDUCATION EXCHANGE (HEX) is operated by AMRAD for those involved in education and communications for the handicapped. It accepts both 110/300-baud ASCII and deaf TTY callers. on 301-593-7033. The sysop Dick Barth, W3HWN's home phone is 301-681-7372.

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THE AMRAD LIBRARY is operated by Tedd Riggs, KC4YN, 8402 Berea Ct, Vienna, VA 22180, phone 703-573-5067. Donations of technical books, magazines, manuals and catalogs are tax-deductible.

AMRAD IS AFFILIATED with the American Radio Relay League (ARRL), the Foundation for Amateur Radio, the Northern Virginia Radio Council (NOVARC) and The Mid Atlantic Repeater Council (T-MARC).

SPECIAL INTEREST GROUPS are formed from time to time. Currently we have SIG's on Deaf Communications and Spread Spectrum Communications. If you are interested in joining or forming a SIG, please contact Bill Pala, WB4NFB, 5829 Parakeet Dr, Burke, VA 22015; phone 703-323-8345.

TRAINING CLASSES are run as needed. Please discuss your training requirements with any Director.

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